

## ON THE AUSTRALIAN FAIRY-RING PUFF-BALL.

*(Lycoperdon furfuraceum, Schaeff.)*

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*(Communicated by J. H. Maiden, F.L.S., &c.)*

(Plate xlvii.)

In February, 1898, it was officially brought under my notice that several bowling-greens in the neighbourhood of Melbourne were being much injured by having bare patches in the form of rings. The caretakers of the greens at first considered these to be due to grubs in the soil, but when the various remedies they tried failed (such as a dressing of soot, which really aggravated the mischief), then my services were called into requisition. On visiting the bowling-greens, the otherwise bare patches were found to be studded with knobby or flattened puff-balls, the rolling and working of the green preventing their further development above ground, and the numerous distinct and fairly large circles showed at a glance that here we had to do with the well known "Fairy-rings," although not hitherto observed or at least recorded in Australia. Since the minute puff-balls did not come to maturity and shed their spores, from the roller being constantly at work, I had a small circle partitioned off, and soon plenty of the puff-balls grew to their full size and shed their spores freely. It was then possible to determine the species, and as it formed such decided rings and caused considerable damage, I have fully described and illustrated it in the present paper. My attention having been called to the subject, it was soon discovered that these rings were by no means rare. In the well-kept lawn at the Flemington Racecourse, I found the same puff-ball producing segments of circles, and at the Caulfield Racecourse they were very plentiful. In these localities bare patches were not formed, but within the ring of puff-balls the grass was greener and of a

denser growth, so that the circles or segments of circles were readily seen at a distance. Since, however, the bowling-greens exhibited the most marked effects of the fungus within a limited area, I will confine myself to a description of them.

In a plan accompanying a preliminary report\* on the subject, drawn to scale by an officer of the Public Works Department, one of the bowling-greens is shown with nine rings more or less distinct, within an area of about one-quarter of an acre. They varied in size from 8-24 feet in diameter; sometimes they were solitary, at other times they formed a chain of three, or one might be within another. They were visible to the ordinary observer at a glance, because the circle was comparatively bare of grass, and in some instances so bare as to be more like a foot-path than anything else.

Rings are sometimes divided into two classes—one with a ring only, and the other with dead grass in the centre; but here they were all distinct rings with the exception of one, in which there seemed to be the blending of two segments of different circles, forming a pear-shaped outline, with a smaller complete circle in the centre of the larger segment.

In this particular green, the caretaker had observed the rings some nine years ago when they were very small, and he was surprised to find them growing bigger every year. It was suggestive that wherever these rings appeared the self-same fungus was found, even at such distances as the lawn at Flemington and the Caulfield Racecourse. Where growing normally there were no bare patches, but in the bowling-green this was a characteristic feature, which may be explained from the different conditions prevailing there. The regular watering of the green encouraged the growth of the fungi, but the constant rolling flattened them out whenever they appeared at the surface, so that only small and distorted specimens could be obtained. The

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\* Department of Agriculture, Victoria—Report by Mr. D. McAlpine, Government Vegetable Pathologist, on Fairy-Rings, and the Fairy-Ring Puff-Ball (Melbourne, 14th May, 1898).

consequence was that the underground or vegetative portion of the fungus spread all the more and enveloped the roots of the grass, so that the soil was literally permeated by the destructive mycelium of the fungus. In this way the destruction of the roots of the grasses would be all the more complete, and no doubt the constant cutting and mowing would hasten the decay of the already languishing grass. In ordinary fairy-rings, too, the circle is almost always imperfect, because some accidental obstacle usually intervenes to prevent the mycelium spreading equally outward. But in the bowling-green the circles were complete, because the conditions there were so uniform. Every portion of the green was regularly watered, rolled and cut, so that the mycelium had an equal chance to spread all round.

In seeking to account for the presence of the puff-ball in the bowling-greens around Melbourne, the fact was elicited that only in those cases where fresh sheep-manure had been used as a top-dressing did the rings appear. I also observed that in the early morning the puff-balls were uprooted and scattered by birds (Minahs and Starlings particularly), and no doubt they would carry the spores and even the spawn with them to other places. This happened in the reserved spot where the puff-balls grew to maturity.

In suggesting a remedy, I discouraged the use of fresh natural manure as a top-dressing; and the application of sulphate of iron at the rate of 1lb. to 2 gallons of water, or a 5 per cent. solution, prevented the appearance of any fresh fungi. Of course the ground was thoroughly soaked with the solution so as to reach the underground mycelium, and it was found best to apply it when the ground was dry and absorbent. Various fungi are known to form rings, as well as other plants, but I am not aware of many puff-balls adopting this habit of growth. Berkeley\* refers to *Lycoperdon caelatum*, Fr., as often forming rings in pastures, which it also does in New Zealand, and Professor Farlow† notices *L. cyathiforme*, Bosc., as forming fairy-rings

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\* Outlines of British Fungology, p. 302 (1860).

† Year Book of U.S. Dept. of Agriculture, 1897, p. 469.

which sometimes injure the lawns in suburban districts. The Fairy-ring Fungus (*Marasmius oreades*, Fr.) has not been found in Australia.

The ring-forming habit belongs also to lichens and mosses, as well as some of the higher plants, and in Sweden a grass popularly known as *elf dansar* has become celebrated as the ring-forming plant.

*L. furfuraceum*, Schaeff., is here newly recorded for Australia, although from the perplexing synonymy given by Saccardo\* it might seem as if already recorded.

*L. pusillum*, Batsch, was determined by Kalchbrenner† in 1875, and was sent to him from Rockhampton, in Queensland. Then Dr. Cooke, in his "Fungi Australiani," gives the same species for New South Wales and West Australia in addition to Queensland, and Saccardo,‡ in his "Sylloge Fungorum," makes *L. furfuraceum*, Schaeff., the equivalent of *L. pusillum*, Batsch.

These two species differ considerably in size, but the main distinction lies in the former having a well developed sterile base, while in the latter it is obsolete. So important is this difference from the systematic point of view, that in the modern classification of the genus *Lycoperdon* there are two leading divisions recognised—(1) those with sterile base rudimentary or absent, and (2) those with sterile basal stratum well developed. *L. pusillum*, already recorded for Australia, belongs to the first division, while *L. furfuraceum* belongs to the second division; and there is no doubt upon this point, since Schaeffer in his original drawings of the species shows the sterile base as in our own specimens. The present species has also been verified by Masee of the Royal Gardens, Kew, England, so that its identity may be regarded as established. In the suburbs of Melbourne this species was very common indeed, and could be gathered by hundreds in the season, and it is somewhat surprising that it should have been so long overlooked, unless it is one of those

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\* Syll. Fung. Vol. vii. p. 110 (1888).

† Grevillea, Vol. iv. p. 74 (1875).

‡ *Loc. cit.*

cases where fungi suddenly appear in a new locality. It should be looked for in the other colonies as well, and it would be interesting to note if, under different conditions of soil and climate, heat and moisture, it grows in the form of "fairy rings."

*LYCOPERDON FURFURACEUM*, Schaeff.—**Fairy-ring Puff-ball.**

Gregarious, often in clumps of three to five, often distorted from mutual pressure, with the odour of mushrooms. Subglobose to oblong, either depressed or somewhat elongated, variable in size, up to  $2\frac{1}{4}$  in., broad and high, usually sessile on a broad base of attachment with numerous root-like fibres, or tapering slightly towards base, and with distinct brown root in young state.

Outer peridium at first quite distinct and easily peeled off, creamy-white, studded all over with closely crowded minute conical spikes, which ultimately disappear, especially on top. Inner peridium white at first, smooth, elastic, membranaceous, finally of a greyish-green colour, dehiscing irregularly at top, or forming at first an elongated oval slit.

Cellular sterile base well-developed, about half the height of peridium, compact, generally flat; pale seal-brown in mass; filaments yellowish-green, flexuous, non-septate, very sparingly branched,  $2-2\frac{1}{2}$   $\mu$  broad, stained yellowish by potassium-iodide-iodine.

Capillitium well-developed, persistent; threads pale green, flexuous, septate, sparingly branched, branches sometimes at right angles, very slender or up to 6  $\mu$  broad.

Spores dark olive-green or bronze-green in mass, yellowish-green individually, globose, smooth, rarely with hyaline pedicel,  $3\frac{1}{2}-4$   $\mu$  in diameter. Stained yellowish-brown by potassium-iodide-iodine.

Near Melbourne, Victoria: in grassy places, on bowling-greens and lawns, forming distinct fairy-rings; summer and autumn, February-May.

The shape and size were very variable; sometimes it was broader than high, and sometimes the height was one-half more than the breadth. The sterile base is generally flat, and the inner

peridium in old specimens may spread out in lobes after the spores are dispersed, completely exposing the compact sterile base. The spores did not exceed  $4\mu$  in diameter. When young and about the size of hazel-nuts, the puff-balls were creamy-white and spiky, and quite firm to the touch, being fixed in the soil by a single distinct root. Then towards maturity they become cinnamon-brown on top, soft and springy to the touch, and the original root has branched considerably, the puff-ball being fixed by a mass of dark-brown root-like fibres. At this stage the spikes can be easily rubbed off, if they do not fall away naturally.

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EXPLANATION OF PLATE XLVII.

*Lycoperdon furfuraceum*, Schaeff.

- Fig. 1.—Small puff-ball, with single root springing from base.  
Fig. 2.—Nearly mature puff-balls.  
Fig. 3.—Top of puff-ball showing dehiscence at first.  
Fig. 4.—Outline section showing sterile base.  
Fig. 5.—Threads of capillitium ( $\times 1000$ ).  
Fig. 6.—Filaments of sterile base ( $\times 1000$ ).  
Fig. 7.—Group of spores ( $\times 1000$ ).